

Syllabus for the trade
of
FITTER
(SEMESTER PATTERN)
Under
CRAFTSMAN TRAINING SCHEME

Designed in
2013

By
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Ministry of Labour & Employment
Directorate General of Employment & Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Block - EN - 81 SECTOR – V, SALT LAKE CITY,
KOLKATA – 700 091

**List of members of Trade Committee meeting for the Trade of FITTER Held on
12.08.2010 & 13.08.2010 at CSTARI, Kolkata**

SL. NO.	NAME AND DESIGNATION S/SHRI	REPRESENTING ORGANIZATION	REMARKS
1	S.D.Lahiri, Director	C.S.T.A.R.I, Kolkata	Chairman
2	S. Bhattacharya, Director	W.B.R.E.D.A, Kolkata	Member
3	Amarnath Sanyal, Addl, Director	I.EM, Kolkata	Member
4	R. Gangopadhyay, Lecturer	Kanchrapara Railway Workshop, Eastern-Railway	Member
5	R, N. Banerjee, Director	Sunshine Power Products, Kolkata	Member
6	P. K. Ghosh, Training Manager	G.R.S.E. Ltd, Kolkata	Member
7	S. K. Pal, Manager	M/s Mascot Integrated Industry, Kolkata	Member
8	Dr. Soumen Bose, Dy, Director	Directorate of Industrial Training, WB	Member
9	Dibyendu Paul, Lecturer	Sahaj Academy, Kolkata	Member
10	Dr. Tapas Kr Majumder, Manager	B S N L, Kolkata	Member
11	S.K.Bose, Manager	Trans Bio Energy Ltd, Kolkata	Member
12	Monisha Sarkar, Asstt Manager	Trans Bio Energy Ltd, Kolkata	Member
13	Dr.K. mukhopadhyaya, Director	AGNI, Kolkata	Member
14	Anupam Bose, Manager	Geetanjali Solar, Kolkata	Member
15	A Majumder, DE	W.B.R.E.D.A, Kolkata	Member
16	Joy Chakraborty, DE	W.B.R.E.D.A, Kolkata	Member
17	Utpal Kr Roy, Supervisor	W.B.R.E.D.A, Kolkata	Member
18	A.Ghosh, Supervisor	W.B.R.E.D.A, Kolkata	Member
19	Moloy Kr Mondal, Supervisor	W.B.R.E.D.A, Kolkata	Member
20	Rudrendu Basu, Asstt. Director	W.B.R.E.D.A, Kolkata	Member
21	S.K.Biswas, Asstt Director	W.B.R.E.D.A, Kolkata	Member
22	D.K.Hazra, Spervisor	W.B.R.E.D.A, Kolkata	Member
23	A.Karmakar, Supervisor	W.B.R.E.D.A, Kolkata	Member
24	Gautam Banerjee, Manager	ESAB India Ltd, Kolkata	Member
25	M.K.Saha, Trg Superintendent	G.R.S.E. Ltd. Kolkata	Member
26	P.Majumder, Chief Consultant	Park Chember Housing Development, Kolkata	Member
27	Rabin Debnath, Asstt. Director	Directorate of Industrial Training, WB	Member
28	Sib Chandra Pal, Instructor	Govt, ITI, Howrah Homes, WB	Member
29	D.P.Sarkar, Instructor	Govt, ITI, Howrah Homes, WB	Member
30	Anil Kumar, Joint Director of Trg	C.S.T.A.R.I, Kolkata	Member
31	L. K. Mukherjee, Dy.Director of Trg	C.S.T.A.R.I, Kolkata	Member
32	A. Nandi, Dy.Director of Trg	C.S.T.A.R.I, Kolkata	Member
33	N.Nath, Asstt. Director of Trg	C.S.T.A.R.I, Kolkata	Member
34	P.K.Dutta, Asstt. Director of Trg	C.S.T.A.R.I, Kolkata	Member
35	S. B. Sarder, Asstt. Director of Trg	C.S.T.A.R.I, Kolkata	Member
36	R. N. Manna, Trg. Officer	C.S.T.A.R.I, Kolkata	Member
37	L. M. Pharikhal, Trg-Officer	ATI, Kolkata	Member

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Mukherjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

General Information

1. Name of the Trade : FITTER
2. N.C.O. Code No. : 842.10, 842.15
3. Duration : 2 Years (Four Semesters having duration of six months each)
4. Power norms : 3.51 KW
5. Space norms : 88 Sq.m
6. Entry Qualification : Passed 10th class examination under 10+2 system of education with Science and Mathematics or its equivalent.
7. Unit Size (No. of Student) : 16
- 8a. Instructor's/Trainer's Qualification: Degree in Mechanical Engineering from recognized engineering College /university with one year experience in the relevant field
- OR
- Diploma in Mechanical Engineering from recognized board Of technical education with two years experience in the relevant
- OR
- 10th Class Pass + NTC/NAC in the Trade of "Fitter"
With 3 years post qualification experience in the relevant field.
- 8b. Desirable qualification : Preference will be given to a candidate with CIC (Craft Instructor Certificate)

Note: At least one Instructor must have Degree/Diploma in Mechanical Engineering.

Syllabus for the Trade of “Fitter”

Under Craftsman Training Scheme

First Semester

(Semester Code no. FTR -

01) Duration : Six Month

Week No.	Trade Practical	Trade Theory	Engineering Drawing	Vocational Science and Calculation
1.	<p>Familiarization with the Institute, Importance of trade training, Machinery used in the trade, types of work done by the trainees in the trade. Introduction to safety equipments and their uses. Introduction of first aid, Road safety, operation of Electrical mains.</p> <p>Occupational Safety & Health</p> <p>Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Use of Fire extinguishers. Visit & observation of sections.</p>	<p>Importance of safety and general precautions observed in the Institute and in the section. Importance of the trade in the development of Industrial economy of the country. What are the related instructions, subjects to be taught, achievement to be made,. recreational, medical facilities and other extracurricular activities of the Institute. (All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Introduction of First aid. Road safety. Operation of electrical mains. Introduction of safety kits. Presentation by CD or DVD of safety to the newly admitted trainees so that they can know reason of accidents.</p>		
2.	<p>Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions, sawing different types of metals of different sections.</p>	<p>Safety, accident prevention, linear measurements- its units, dividers, calipers, hermaphrodite, centre punch, dot punch, their description and uses of different types of hammers. Description, use and care of 'V' Blocks, marking off table.</p>	<p>Engineering Drawing-- introduction to Engg. Drawing,, its importance.</p>	<p>Introduction to Property and uses of C.I. and wrought Iron.</p>
3.	<p>Filing Channel, Parallel. Filing- Flat and square (Rough finish).</p>	<p>Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their</p>	<p>Types of lines their meaning & application as per BIS 696</p>	<p>Arithmetic: Fundamental operations,- addition , subtraction.</p>

		uses, method of using hacksaws.		multiplication, division of decimal number
4.	Filing practice, surface filing, marking of straight and parallel lines with odd leg calipers and steel rule, marking practice with dividers, odd leg calipers and steel rule (circles, arcs, parallel lines).	Files- specifications, description, materials, grades, cuts, file elements, uses. Measuring standards (English, Metric Units), angular measurements, subdivisions, try square, ordinary depth gauge, protractor- description, uses and cares.	Simple conventional symbols for material and parts as per BIS ---696	Properties and uses of plain carbon steel and alloy steel.
5.	Marking off straight lines and arcs using scribing block and dividers, chipping flat surfaces along a marked line.	Marking off and layout tools, dividers, scribing block, odd leg calipers, punches- description, classification, material, care & maintenance.	Use of drawing instruments in the construction of Geometrical drawings- angles, triangles.	Fraction and decimal - conversion fraction decimal and vice-versa.
6.	Marking, filing, filing square, use of tri-square.	Calipers- types, material, constructional details, uses, care & maintenance of cold chisels- materials, types, cutting angles.	Geometrical construction of rectangles, square, circles.	Properties and uses of copper, zinc, lead, tin, aluminum.
7&8	Marking according to simple blue prints for locating, position of holes, scribing lines on chalked surfaces with marking tools, finding center of round bar with the help of 'V' block and marking block. Joining straight line to an arc.	Marking media, marking blue, Prussian blue, red lead, chalk and their special application, description. Use, care and maintenance of scribing block.	Geometrical construction of polygon and ellipse, parabola & hyperbola.	Composition, properties and uses of brass, bronze, solder, bearing material, timber, rubber etc.
9.	Chipping, Chip slots & oils grooves (Straight). Filing flat, square, and parallel to an accuracy of 0.5mm. Chip curve along a line-mark out, key ways at various angles & cut key ways.	Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types and uses, workshop surface plate- their uses, accuracy, care and maintenance. Types of files- convexing, taper, needle, care and maintenance of files, various types of keys, allowable clearances & tapers, types, uses of key pullers.	Geometrical construction of involutes, oval, and helix.	System of units, British, metric and SI units for length, area, volume capacity, weight, time, angle, their conversions. Effect of alloying elements in the properties of C.I. & steel.
10.	File thin metal to an accuracy of 0.5 mm. Chip & chamfer, grooving and slotting	Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness,	Free hand sketching of straight lines, rectangles, circles, square, polygons, ellipse.	Unit of temperature for & related problems. Standard & absolute temp.

		brittleness, toughness, tenacity, and elasticity.		
11.	Saw along a straight line, curved line, on different sections of metal. Straight saw on thick section, M.S. angle and pipes.	Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine.	Free hand sketching of straight lines, rectangles, circles, square, polygons, ellipse.	Mass, volume, density, sp. Gravity & specific weight S.I. M.K.S. and F.P.S. units of force, weight etc. their conversion to related problems.
12.	File steps and finish with smooth file accuracy \pm 0.25 mm. File and saw on M.S. Square and pipe welds	Micrometer- outside and inside – principle, constructional features, parts graduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer.	Standard printing style for letters and numbers as per IS : 696.	Mass, volume, density, weight, S.I. , M.K.S. and F.P.S. units of force weight etc. their conversion to related problems.
13.	File radius along a marked line (Convex & concave) & match. Chip sheet metal (shearing). Chip step and file.	Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital vernier caliper.	Free hand sketching of simple geometrical solids, cube, cone, prism, cylinder, sphere, pyramids.	Inertia, rest and motion, velocity and acceleration.
14.	Punch letter and number (letter punch and number punch), use of different punches.	Drill holding devices- material, construction and their uses.	Scales- construction plan, Representing fraction	Concept of scalar and vector quantity with examples, Newton's Law of motion.
15.	Prepare forge. Fire for heating metals. Forge a square rod from round stock. Judge the forging temperature of various metals.	Safety precautions to be observed in a smith shop, forge - necessity, description uses, fuel used for heating, bellows blowers, description and uses.	Construction of diagonal scale.	Power and roots Factor, Power base exponents number.
16.	Forge M.S. bar to square, octagon and hexagon.	Anvil and swage blocks. Description and uses. Forging tools- hammers- band and sledge, description and uses. Chisels, set hammers, flatters, hardier, fuller swage & uses.	Simple dimensioning technique, size and location, dimensions of parts, holes angles, taper, screw etc. as per BIS. 696.	Multiplication and division of power and root of a number.
17.	Forge flat chisel, grind.	Measuring and checking tools- steel rule, brass rule, calipers, try square, description and uses. General idea about the main operations performed in a forging shop such as upsetting drawing, twisting, bending, punching, drilling, and	Transferring measurements for linear, angular, circular dimensions form the given object to the related free hand sketches using different	Square root of number and problems

		welding.	measuring instruments.	
18.	Forge – punches, screw drivers, chisels, grind them to shape and heat treat to requirement, bending metals to angles, curves & twisting, Preparation of brackets.	Heat treatment, various heat treatment methods - normalizing, annealing, hardening and tempering. Power hammer – construction, features, method of operating and uses.	Pictorial drawings, isometric drawings of simple geometrical solids.	Work energy and power, their units and applied problems.
19.	Marking of straight lines, circles, profiles and various geometrical shapes and cutting the sheets with snips. Marking out of simple development, marking out for flaps for soldering and sweating.	Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications.	----do-----	----do-----
20	Make various joints: wiring, hemming, soldering and brazing, form locked, grooved and knocked up single hem straight and curved edges form double hemming,. Punch holes- using hollow and solid punches. Do lap and butt joints.	Marking and measuring tools, wing compass, Prick punch, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, stakes-bench types, parts, their uses. Soldering iron, types, specifications, uses. Trammel- description, parts, uses. Hand grooves- specifications and uses.	Oblique projection of simple geometrical solids.	Percentage, changing percentage to decimal and fraction and vice versa. Applied problems.
21.	Bend sheet metal into various curvature form, wired edges- straight and curves, fold sheet metal at angle using stakes. Bend sheet metal to various curvatures. Make simple Square, container with wired edge and fix handle.	Solders-composition of various types of solders, and their heating media of soldering iron, fluxes types, selection and application-joints wiring-various types of metal joints, their selection and application, tolerance for various joints, their selection & application.	Oblique projection of simple geometrical solids.	Problem on percentage related to trade.
22.	Make square tray with square soldered corner Make funnel as per development and solder joints Make riveted lap and butt joint. Welding - Striking and maintaining arc, laying straight-line bead.	Rivets-Tin man's rivets, types, sizes, selection for various works. Riveting tools, dolly snaps, description and uses. Method of riveting, shearing machine-description, parts and uses. Safety-importance of safety and general precautions observed in a welding shop. Precautions in electric and gas welding. (Before, during, after) Introduction to safety equipment and their uses.	Isometric drawing of simple machined & casting blocks.	Different types of loads, stress, strain, modulus of elasticity. Ultimate strength, different types of stress, factor of safety, examples.

23-24.	Making square, butt joint and 'T' fillet joint-gas and arc. Do setting up of flames, fusion runs with and without filler rod, gas and arc. Make butt weld and corner, fillet welding- Gas and Arc. Practice in soft soldering and silver soldering. Gas cutting.	Hand tools: Hammers, welding description, types and uses, Machines and accessories, welding transformer, welding generators, description, principle, method of operating, carbon dioxide welding. H.P. welding equipment: description, principle, method of operating L.P. welding equipment: description, principle, method of operating. Types of Joints-Butt and fillet as per BIS specifications. Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses. Gases and gas cylinder description, kinds, main difference and uses.	----do--- Free hand sketches of trade related hand tools and measuring tools.	----do---- Ratio & proportion- Ratio, finding forms ratio proportions, direct proportion and indirect proportion. Application of ratio and proportion & related problems.
25.	Project Work / Industrial Visit (Optional)			
26.	Examination			

Syllabus for the Trade of “Fitter”

Second Semester

(Semester Code no. FTR -

02) Duration : Six Month

Sl.No.	Trade Practical	Trade Theory	Engineering Drawing	Vocational Science and Calculation
1	True job on four jaw chuck using knife tool, face both the ends for holding between centers, Using roughing tool parallel turn ± 0.1 mm. Measure the diameter using outside caliper and steel rule.	Safely precautions to be observed while working on a lathe, Lathe specifications, and constructional features. Lathe main parts descriptions- bed, head stock, carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centers, works with catch plate, dog, simple description of a facing and roughing tool and their applications.	Simple sketches of trade related hand tools & measuring instruments	Simple machines- principle, velocity ratio, mechanical advantage, efficiency, related problems.
2	Lathe operations- the facing, parting and form tools, plain turn, step turn, holding job in three jaw chuck- deburr, chamfer-corner, round, the ends, Shoulder turn : square, filleted, beveled under cut shoulder, turning-filleted under cut, square beveled.	Lathe cutting tools- Brief study of the nomenclature of Lathe cutting tools and necessity of correct grinding, solid and tipped, throw away type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants.	Machines- basic principles, velocity, ratio, mechanical advantage, and efficient, simple problems.	Simple machines- principle, velocity ratio, mechanical advantage, efficiency. Simple problems.
3	Cut grooves- square, round ‘V’ groove, Make a mandrel-turn diameter to sizes. Knurl the job.	Chucks and chucking the independent four-jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck- mounting and dismounting, chucks, chucking true, face plate, drilling - method of holding drills in the tail stock, Boring tools and enlargement of holes.	Orthographic drawings, application of both the first angle and third angle. Method of representing the drawings for simple and complex machine parts, exercises with dimensions.	Algebraic symbols, fundamental algebra operations, sign and symbols used in algebra, coefficient terms, and unlike terms.

4	Bore holes –spot face, pilot drill, enlarge hole, using boring tools, make a bush step bore-cut recess, turn hole diameter to sizes.	General turning operations- parallel or straight, turning. Stepped turning, grooving, shape of tools for the above operations. Appropriate method of holding the tool on tool post or tool rest, Knurling: - tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation.	----do----	Algebraic addition, subtraction, multiplication and division.
5	Turn taper (internal and external). Turn taper pins. Turn standard tapers to suit with gauge.	Taper – definition, use and method of expressing tapers. Standard tapers-taper, calculations Morse taper.	Orthographic drawings application of both the first angle and third angle. Method of representing the drawings for simple and complex machine blocks given for exercises with dimensions.	Power and exponent. Laws of exponent.
6	Threading practice by using cut threads using taps, dies on lathe by hand, 'V' thread – external. Prepare a nut and match with the bolt.	Screw thread definition – uses and application. Terminology of screw threads, square, worm, buttress, acme (non standard-screw threads),Principle of cutting screw thread in centre lathe –principle of chasing the screw thread – use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread.	-----do-----	Algebraic simplification problems.
7	Mark off and drill through holes, drill on M.S. flat, file radius and profile to suit gauge.	Drill- material, types, (Taper shank, straight shank) parts and sizes. Drill angle-cutting angle for different materials, cutting speed feed.	Standard method of sectioning as per B IS: 696. Exercises for different sectional views on the given	Simple machines like winch pulley and compounding axle etc.

		R.P.M. for different materials.	orthographic drawing of machine part, castings etc	
8	Step fit, angular fit, file and make angle, surfaces (Bevel gauge accuracy 1 degree) make simple open and sliding fits.	Drill troubles: causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds : Fraction, metric, letters and numbers, grinding of drill.	----do---	Factors and equations: Algebraic formula.
9	Enlarge hole and increase internal dia. File cylindrical surfaces. Make open fitting of curved profiles.	Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Bench grinder parts and use-radius gauge, fillet gauge, material, construction, parts function and metric, different dimensions, convex and concave uses care and maintenance.	----Do----	Factors and different types of factorisation.
10	Make the circles by binding previously drilled hole. Test angular match up.	Radius gauge, feeler gauge, hole gauge, and their uses.	Standard method of sectioning as per BIS.696 Exercises for different sectional views on the given orthographic drawing of machine parts, casting etc	Equations simple simultaneous equation
11-12	Inside square fit, make combined open and sliding fit, straight sides 'T' fit.	Vernier height gauge : material construction, parts, graduations (English & Metric) uses, care and maintenance, Pig Iron : manufacturing process (by using) Blast furnace types, of pig Iron , properties and uses.	Conversion of isometric, oblique drawings to orthographic drawings and vice-versa. Related problems such as 'V' block oriented by various machining operations etc.	Equation simple simultaneous, quadratic.

13	File fit- combined, open angular and sliding sides. File internal angles 30 minutes accuracy open, angular fit.	Cast Iron: manufacturing process by using (cupola furnace) types, properties and uses. Wrought iron- : manufacturing process (Fuddling and Astor process) properties and uses.	-----do-----	Application, construction and solution of problems by equation.
14	Make sliding fit with angles other than 90 ^o , sliding fit with an angle.	Steel: manufacturing process plain carbon steels, types, properties and uses.	-----do---	Atmospheric pressure, pressure gauge, gauge pressure and absolute pressure and their units.
15	Make simple bracket by bending and twisting of non-ferrous metal. Drill small holes (2mm) Drill holes on sheet metal, bend short for round bracket.	Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses.	-----do---	Logarithms and use of logarithms tables:
16	Form internal threads with taps to standard size (through holes and blind holes) – Drill through hole and tap drill blind hole and tap, prepare studs and bolt.	Screw threads: terminology, parts, types and their uses. Screw pitch gauge: material parts and uses. Taps British standard (B.S.W., B.S.F., B.A. & B.S.P.) and metric /BIS (course and fine) material, parts (shank body, flute, cutting edge). Method of using and use of calculating tap hole sizes. Tap wrench: material, parts, types (solid & adjustable types) and their uses removal of broken tap, studs (tap stud extractor).	-----do-----	Logarithms: logarithm and exponent. Use of logarithms and anti-logarithm table.
17	Form external threads with dies to standard size. Prepare nuts and match with bolts.	Dies : British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses.		Arithmetical operations involving logarithms in the computations.

18	Counter sink, counter bore and ream split fit (three piece fitting).	Counter sink, counter bore and spot facing-tools and nomenclature, Reamer- material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure.	----do----	Problem related to the trade using logarithm tables.
19	Filling & scraping of bearing to close precision.	Scrapers and their types, methods of scraping.	----do----	----do----
20	File and fit combined radius and angular surface (accuracy ± 0.5 mm), angular and radius fit. Locate accurate holes. Make accurate hole for stud fit.	Vernier micrometer, material, parts, graduation, use, care and maintenance.	Surface development of simple geometrical solids like cube, rectangular block, cone, pyramid, cylinder, prism etc.	Specific gravity, principle of Archimedes.
21	Make assembly for dovetail sliding fits using lower pins and screws (± 0.04 mm)	Screw thread micrometer: Construction, graduation and use.	----do---	Relation between specific gravity and density simple experimental determination.
22	Cutting threads using dies. Make sliding fits assembly with parallel and angular mating surface. (± 0.04 mm)	Dial test indicator, construction, parts, material, graduation, Method of use,. Care and maintenance. Digital dial indicator. Comparators- measurement of quality in the cylinder bores.	----do---	Geometry: Fundamental geometrical definition- angles and properties of angles, triangles, and properties of triangles.
23 & 24	Simple repair work, simple assembly of machine parts from blue prints	Preventive maintenance- objective and function of P.M., section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of handbooks and reference table.	Interpretation of solids and conventional application of intersectional curves on drawing. Solution of NCVT test paper (preliminary) Revision.	Pythagoras theorem, properties of similar triangles. Revision.
25	Project Work / Industrial Visit (Optional)			
26	Examination			

Syllabus for the Trade of “Fitter”

Third Semester

(Semester Code no. FTR -

03) Duration : Six Month

Week No.	Trade Practical	Trade Theory	Engineering. Drawing	Vocational Cal. & Science
01	Prepare triangle, hexagon on ends of a cylinder bar, prepare female end and fit.	Keys and keyways. Types and their uses, construction (shape).	Revision of first year topics.	Revision of 1 st year course.
02	Make key and keyways on the shaft and fit. “V” grooves and slots on the cast iron block.	Spring-material types and uses.	---do---	---do---
03	Make riveted joints (lap and butt joints)	Bolts and Nuts: Material, types (Hexagonal and square head) and their uses.	Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.	Rectangle, square, Rhombus, parallelogram and their properties.
04	Drill on cylindrical surface.	Washers: Material, types (spring, tab, plain washer and fiber washer).	----do---	Circle and properties circle: regular polygons.
05	Scrap on flat surfaces, scrap on curved surfaces and scrap surface parallels and test. Make & assemble, sliding flats, plain surfaces.	Simple scraper- cir., flat, half round, triangular and hook scraper and their uses.	Sketches for bolts, nuts, screws and other screwed members.	Application of geometrical to shop problems.
06	Make simple dowel pins, fitting dowel pins and tap screw assembly.	Dowel pins : material, construction, types ,accuracy and uses.	Sketches for bolts, nuts, screws and other screwed members.	Heat & temperature, thermometric scales, their conversions.
07	Assembly sliding for using keys and dowel pin and screw, ± 0.02 mm accuracy on plain surface.	Screws: material, different types (inch & metric), uses	Standard rivet forms as per BIS.	Temperature measuring instruments.
08	Testing of sliding fitting job, scrap on two flat surfaces and curved surfaces.	Testing scraped surfaces: ordinary surfaces without a master plate.	--do--	Specific heats of solids & liquids., quantity of heat.
09	File & fit angular mating surface plain	Special files: types (pillar, Dread naught, Barrow,	Riveted joint.	Heat loss and heat gain, with simple

	within an accuracy of ± 0.02 mm & angular 15 minutes angular fitting.	warding) description.		problems.
10	Drill through and blind holes at an angle-drill blind holes, 'Y' fitting.	System of drill size, Fractional size: number, letter and metric. Templates and gauges- Introduction, necessity, types.	Riveted joints- butt.	Mensuration: Plain figures-triangles, square, rectangle, parallelogram.
11	Dovetailed fitting, radius fitting.	Gauges: Introduction, necessity, types- description and uses of gauge- types (feeler, screw, pitch, radius, wire gauge), description and use.	Sketches of keys, cotter and pin joints.	Plain figures. Trapezium, regular polygons, circle, hollow circles.
12	Precision drilling, reaming and tapping. Test- Job.	Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses.	----do---	Plain figures- segment and sector of circle, ellipse, fillets.
13	File and fit, combined fit with straight, angular surface with ± 0.02 mm accuracy, hexagonal fitting.	Slip gauge: Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance. Application of slip gauges for measuring, Sine bar- Principle, application & specification.	Sketches for simple pipe, unions with simple pipe line drawings.	Solid figures: Prism, cylinder, pyramid, cone.
14	Drilling and reaming, small dia. holes to accuracy correct location for fitting Make male and female fitting parts, drill and ream holes not less than 12.7 mm.	Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use.	---do---	Solid figures: frustum of a cone, sphere, spherical segment.
15	Sliding fitting, Diamond fitting, Lapping flat surfaces using lapping plate.	Lapping: Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface	Concept of preparation of assembly drawing and detailing. Simple assemblies	Material weight and cost problems related to trade.

		finish importance, equipment for testing-terms relation to surface finish. Equipment for tasting surfaces quality – dimensional tolerances of surface finish.	& their details of trade related tools/job/exercises with the dimensions from the given sample or models. Tool post for the lathe with washer and screw.	
16	Stepped keyed fitting-test job. Lapping holes and cylindrical surfaces.	Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance.	---do---	Trigonometry: trigonometric ratios, use of trigonometric table.
17	Making a snap gauge for checking a dia of 10 ± 0.02 mm.	Interchangeability: Necessity in Engg, field definition, BIS. Definition, types of limit, terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone.	Details and assembly of Vee-blocks with clamps.	Area of triangle by trigonometry.
18	Scrape angular mating surface, scrap on internal surface.	Different standard systems of fits and limits. British standard system, BIS system., Method of expressing tolerance as per BIS	Details and assembly of Vee-blocks with clamps.	Finding height and distance by trigonometry.
19	Practice in dovetail fitting assembly and dowel pins and cap screws assembly.	Fits : Definition, types description of each with sketch.	Details of assembly of shaft and pulley.	Application of trigonometry in shop problems.
20	Preparation of gap gauges.	Manufacture: The name and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization.	Details of assembly of shaft and pulley.	Application of trigonometry in shop problems
21	Dovetail and Dowel pin assembly, scraps cylindrical bore.	Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single	Details of assembly of bush bearing.	Triangle of forces, parallelogram of forces.

		row, double row, description of each, and advantages of double row.		
22	Scrapping cylindrical bore and to make a fit-make a cotter jib assembly.	Roller and needle bearings: Types of roller bearing. Description & use of each. Method of fitting ball and roller bearings.	Details of assembly bush bearing.	Composition and resolution of forces.
23	Scrapping cylindrical taper bore, check taper angle with sine bar, check in per angle (flat) with sine bar.	Bearing metals – types, composition and uses, lubricants purpose of using different types, description and uses of each type.	Details of assembly of a simple coupling.	Representation of forces by vectors-simple problems on lifting tackles like jib cranes, wall cranes etc.
24	Preparation of centre, squares, drills gauges. File and fit straight and angular surfaces internally. Continuation of Filing exercises. Identify different ferrous metals by spark test.	Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings. Hardening and tempering, purpose of each method, tempering colour chart. Annealing and normalizing, purpose of each method.	---do--- Details and assembly of a simple hand vice.	---do--- Moments of force, couples. Simple problems on straight and bell cranked lever.
25	Project Work / Industrial Visit (Optional)			
26	Examination			

Syllabus for the Trade of
“Fitter” Fourth Semester
(Semester Code no. FTR -
04) Duration : Six Month

Week No.	Trade Practical	Trade Theory	Engineering drawing	Vocational science & calculation
01.	'H' fitting-	Case hardening and carburizing and its methods, process of carburizing (solid, liquid and gas).	Details and assembly of simple hand – vice.	Centre of gravity, simple experimental determination, stable, unstable & neutral equilibrium, simple explanation
02.	Exercises on lapping of gauges (hand lapping only)	Solder and soldering: Introduction-types of solder and flux. Method of soldering, Hard solder- Introduction, types and method of brazing.	----do---	---do---
03.	Hand reams and fit taper pin, drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts.	Production of gauges, templates and jigs. The objective of importance for preparing interchangeable components.	---do---	Friction- coefficient of friction.
04.	Simple jigs and fixtures for drilling.	Drilling jig-constructural features, types and uses.	Blue print Reading. Simple exercises related to missing lines.	Simple problem related to friction.
05.	Prepare a 'V' block and a clamp.	Fixtures-Constructural features, types and uses.	---do---	Magnetic substances- natural and artificial magnets.
06	Marking out as per Blue print, drilling, straight and curve filing. Threading with die, cutting slot, and cutting internal threads with taps, making an adjustable spanner.	Revision.	---do---	Method of magnetisation. Use of magnets.
07.	Flaring of pipes and pipe joints,	Pipes and pipe fitting- commonly used pipes. Pipe	---do---	Electricity & its uses electric

	Cutting & Threading of pipe length. Fitting of pipes as per sketch. Conditions used for pipe work to be followed. Bending of pipes- cold and hot.	bending methods. Use of bending fixture, pipe threads- Std. Pipe threads Die and Tap, pipe vices.		current-positive & negative terminals.
08.	Practice-dismantling & assembling – globe valves sluice valves, stop cocks, seat valves and non-return valve, fitting of pipes and testing for leakage.	Standard pipefitting-. Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and house hold taps and pipe work. Use of tools such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc.	Simple exercises relating missing symbols.	Use of fuses and switches, conductors and insulators.
09.	Practice in handling Fire extinguishers of different types, refilling of extinguishers.	Fire precautions-causes and types of fires, precautions against outbreak of fire. Fire Extinguishers-types and use.	Simple exercises relating to missing symbols.	Simple electric circuits ,simple calculations.
10.	Marking detail includes male & female screw cutting, male and female fitting parts. Making and tempering springs.	Working material with finished surface as aluminium, duralumin, stainless steel, the importance of keeping the work free from rust and corrosion. The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments and provide a pleasing finish as chromium silver plating and nickel plating, and galvanizing.	Simple exercises related to missing section.	Ohm's Law. Simple calculation, electrical insulating materials.
11.	Exercises on finished material as aluminium and stainless steel, marking out, cutting to size, drilling etc. without damage to surface of finished articles.	Aluminium and its alloys. Uses ,advantages and disadvantages, weight and strength as compared with steel.	Simple exercises related to missing section.	Graphs : abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.
12.	Making out for angular outlines, filing and fitting the inserts into gaps. Making a simple drilling jig, Marking out, filing to line, drilling and tapping brass and copper jobs.	Tapers on keys and cotters permissible by various standards. Discuss non-ferrous metals as brass, phosphor bronze, gunmetal, copper, aluminium etc. Their composition and purposes where and why used, advantages for	Simple exercises related to missing dimensions.	----do---

		specific purposes, surface wearing properties of bronze and brass.		
13.	Complete exercises covering the assembly of parts working to detail and arrangement – Drawings. Dismantling and mounting of pulleys. Making replacing damaged keys. Repairing damaged gears and mounting. Repair & replacement of belts.	Power transmission elements. The object of belts, their sizes and specifications, materials of which the belts are made, selection of the type of belts with the consideration of weather, load and tension methods of joining leather belts. Vee belts and their advantages and disadvantages, Use of commercial belts, dressing and resin creep and slipping, calculation.	---do---	Practice on simple pocket calculator.
14.	Complete exercises covering the assembly of parts working to details and arrangements as per drawings. Dismantling and mounting of pulleys. Making, replacing damaged keys. Repairing damaged gears and mounting them on shafts.	Power transmissions, coupling types-flange coupling,-Hooks coupling-universal coupling and their different uses.	Further practice on logarithm.	Mechanical properties of metals.
15.	More difficult work in marking out including tangents, templates involving use of vernier protractor.	Pulleys-types-solid, split and 'V' belt pulleys, standard calculation for determining size crowning of faces-loose and fast pulleys-jockey pulley. Types of drives-open and cross belt drives. The geometrical explanation of the belt drivers at an angle.	----do---	----do---
16.	Fitting of dovetail slides.	Power transmission –by gears, most common form spur gear, set names of some essential parts of the set-The pitch circles, Diametral pitch, velocity ratio of a gear set, Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing,	Solution of NCVT test.	Basic Electronics.

		pinion and rack, worm gearing, velocity ration of worm gearing. Repair to gear teeth by building up and dovetail method.		
17.	Male and female dovetail fitting repairs to geared teeth. Repair of broken gear tooth by stud. Repair broker gear teeth by dovetail.	Method or fixing geared wheels for various purpose drives. General cause of the wear and tear of the toothed wheels and their remedies, method of fitting spiral gears, helical gears, bevel gears, worm and worm wheels in relation to required drive. Care and maintenance of gears.	Solution of NCVT test papers.	----do---
18.	Marking out on the round sections for geometrical shaped fittings. Finishing and fitting to size, checking up the faces for universality.	Lubrication and lubricants- Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal. Bearings, method of lubrication-gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants: Soluble off soaps, suds-paraffin, soda water, common lubricating oils and their commercial names, selection of lubricants.	----do---	Transmission of power by belt, pulleys & gear drive. Calculation of Transmission of power by belt pulley and gear drive.
19 & 20	Making-parallel block & 'V' block. Drilling for riveting. Riveting with as many types of rivet as available, use of counter sunk head rivets, use of counter bore tool to fit cheese head bolts. Use of pop rivets and gun.	Chains, wire ropes and clutches for power transmission. Their types and brief description. Discuss the various rivets shape and form of heads, riveting tools for drawing up the importance of correct head size. The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.	----do---	Solution of NCVT test papers.
21 & 22	Inspection of Machine tools. Accuracy testing of Machine tools.	Installation, maintenance and overhaul of machinery and engineering equipment and Hydraulics & pneumatic symbols & exercise. Hydraulics pneumatic circuits. Clutch: Type, positive clutch (straight tooth type, angular tooth type) .	----do---	Basic Electronic control system.

23.	Study of power transmission system in machine tools.	Washers-Types and calculation of washer sizes. The making of joints and fitting packing. The use of lifting appliances, extractor presses and their use. Practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts.	Solution of NCVT test papers.	Basic Electronic control system.
24.	Simple repair of machinery, making of packing gaskets, use of hollow punches, extractor ,drifts, various types of hammers and spanners, etc. Practicing, making various knots, correct loading of slings, correct and safe removal of parts. Erect sample machines.	Foundation bolt: types (rag, Lewis cotter bolt) description of each erection tools, pulley block, crow bar, spirit level, Plumb bob, pipe 2 X 4', wire rope, manila rope, wooden block.	----do---	----do---
25.	Revision			
26.	Examination			

**LIST OF ISI BOOKS FOR REFERENCE FOR
FITTER TRADE. (For use of
Instructors only)**

SL.No.	Titles	Code
1.	Spring calipers.	IS : 4052 – 1967
2.	Punches	IS : 413– 1974
3.	Matric steel scales for Engineers.	IS : 1481 - 1970
4.	Engineers square.	IS : 2013 – 1972
5.	V-Block.	IS : 2049 – 1974
6.	Steel straight edges.	IS : 2220 – 1962
7.	Hacksaw blades.	IS : 2504 - 1977
8.	Bench vices.	IS : 2586 - 1975
9.	Chisels (Cold)	IS : 402- 1974
10.	Engineer's file.	IS : 1931 - 1972
11.	Surface plates (C.I.)	IS : 2285 – 1974
12.	Twist drill	IS : 5100 – 1960 to 5106
13.	Vernier depth gauges.	IS : 4213 – 1967
14.	External micrometers.	IS : 2967 – 1964
15.	A dimension for counter – sinks & counter bores.	IS : 3406 – 1975
16.	Internal micrometers.	IS : 2966 – 1964
17.	Vernier calipers.	IS : 3651 – 1974
18.	Vernier height gauges.	IS : 2021 – 1964
19.	Gib – head keys and key ways.	IS : 2203 – 1974
20.	Taper keys and key ways.	IS : 2292 – 1974
21.	Screw driver.	IS : 884– 1972
22.	Bevel protractors.	IS : 4229 – 1970
23.	Reamers.	IS : 1836 – 1961
24.	Thread cutting dies.	IS : 1859 – 1961
25.	Metric screw threads (Metric thread pitch-gauges)	IS : 4211 – 1967
26.	Dial gauges.	IS : 2092 – 1962
27.	Hexagonal bolts and nuts.	IS : 2038 – 1968
28.	Feeler gauges (m.m. ranges).	IS : 3179 – 1976
29.	Spanners, open jaw.	IS : 2028 – 1968
30.	Thickness of sheet & diameters of wire	IS : 1137 – 1950
31.	Centre drills.	IS : 6703 – 1977
32.	Lathe, sizes for general purpose.	IS : 2392 – 1963
33.	Recommendations for tapping drill sizes.	IS : 3230 – 1970
34.	Needle files.	IS : 3152 – 1965
35.	Plain plug gauges.	IS : 6137 – 1871
36.	Plain ring gauges (Go)	IS : 3435 – 1972
37.	Snap gauges (Go & No Go)	IS : 3477 – 1973
38.	Slip gauges.	IS : 2984 – 1966
39.	Ball & roller Bearings gauging practice for.	IS : 4025 – 1967
40.	V-belt for Industrial purposes.	IS : 2404 – 1974
41.	Limits & fits for engineering, recommendations for	IS : 919 – 1963
42.	Plain limit gauges tolerances for.	IS : 3455 – 1971
43.	Rivets for general purposes.	IS : 2155 – 1961
44.	Tapers for general engineering purposes.	IS : 3458 – 1966
45.	General Engineering drawing.	IS : 696 – 1971